US007199724B2

(12) **United States Patent**
Danvir et al.

(10) **Patent No.: US 7,199,724 B2**
(45) **Date of Patent: Apr. 3, 2007**

(54) **METHOD AND APPARATUS TO AIDE IN EMERGENCY EGRESS**

(75) Inventors: **Janice M. Danvir**, Arlington Heights, IL (US); **Marc K. Chason**, Schaumburg, IL (US); **Katherine M. Devanie**, Arlington Heights, IL (US); **David A. Hume**, Deer Park, IL (US)

(73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 73 days.

(21) Appl. No.: **11/130,648**

(22) Filed: **May 17, 2005**

(65) **Prior Publication Data**

US 2006/0261971 A1 Nov. 23, 2006

(51) **Int. Cl.**
G08B 3/00 (2006.01)
G08B 5/00 (2006.01)
G08B 7/00 (2006.01)

(52) **U.S. Cl.** **340/691.1**; 340/540; 340/577; 340/628

(58) **Field of Classification Search** 340/540, 340/577, 628, 691.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,801,928	A *	1/1989	Minter	340/691.2
5,572,183	A *	11/1996	Sweeney	340/691.4
6,150,943	A *	11/2000	Lehman et al.	340/628
7,026,947	B2 *	4/2006	Faltesek et al.	340/691.1
7,061,392	B2 *	6/2006	Hawkinson	340/691.1
2002/0057204	A1	5/2002	Bligh	
2002/0072881	A1	6/2002	Saitta	
2002/0149491	A1	10/2002	Crandall, Jr. et al.	
2002/0191004	A1	12/2002	Ebersole et al.	
2002/0196202	A1	12/2002	Bastian et al.	
2004/0065813	A1	4/2004	Goldstein	

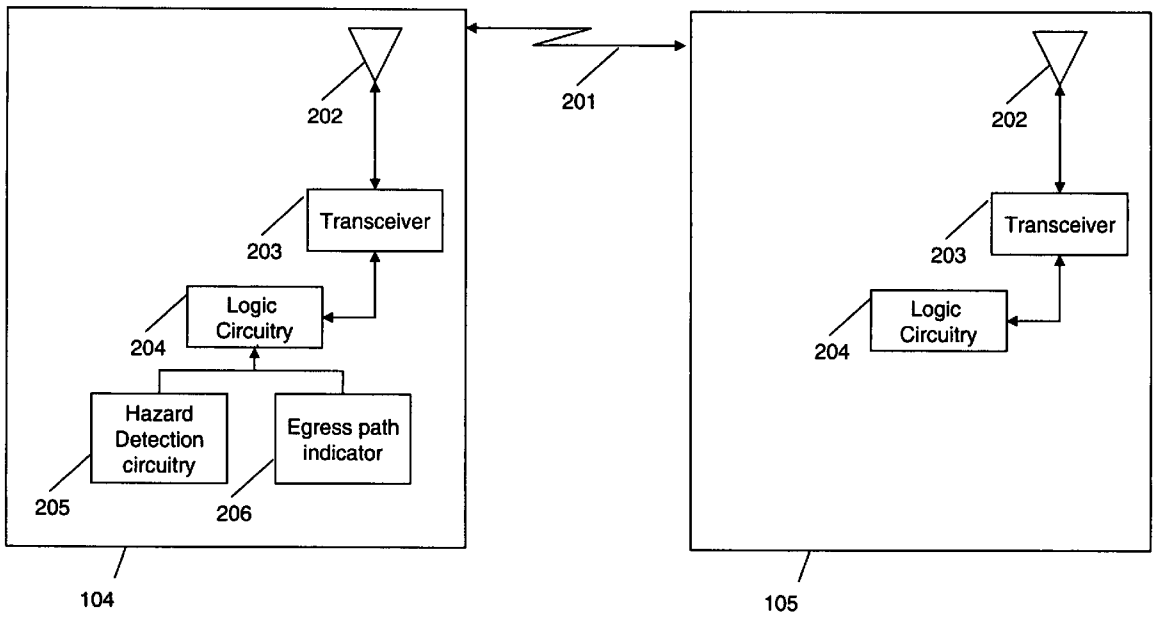
* cited by examiner

Primary Examiner—Michael Horabik
Assistant Examiner—Samuel J Walk

(57) **ABSTRACT**

A method and apparatus are provided to aide in emergency egress of a structure. More particularly, egress indicators are co-located with hazard sensors. During detection of a hazard condition, locations of sensors detecting the hazard are identified and a pathway directing traffic away from the hazard is determined. Finally, the egress indicators are operated to direct traffic down the determined pathway.

11 Claims, 3 Drawing Sheets



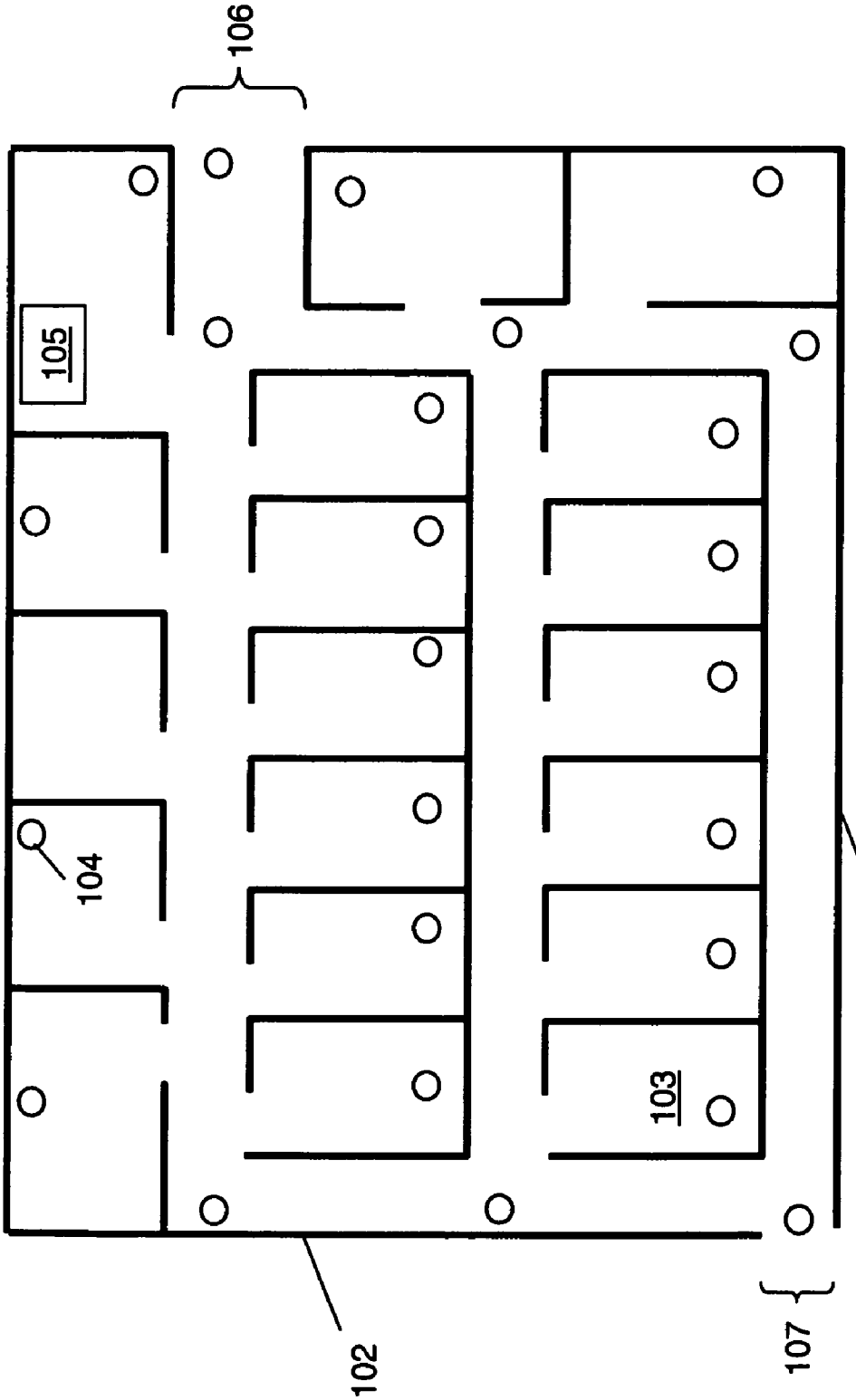


FIG. 1
100

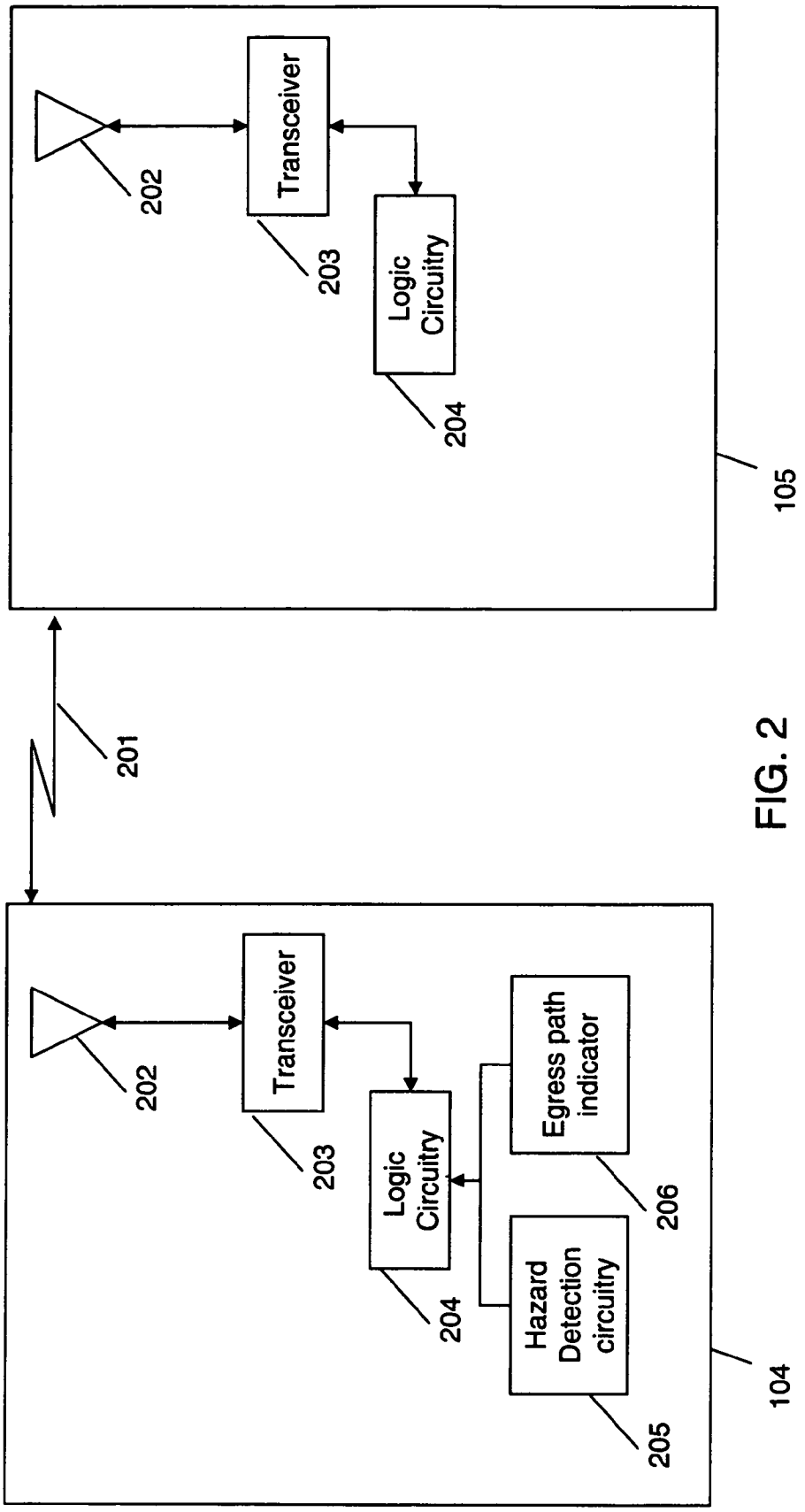

Transceiver
202
203
Logic Circuitry
204
105
201
Transceiver
202
203
Logic Circuitry
204
Egress path indicator
206
Hazard Detection circuitry
205
104

FIG. 2

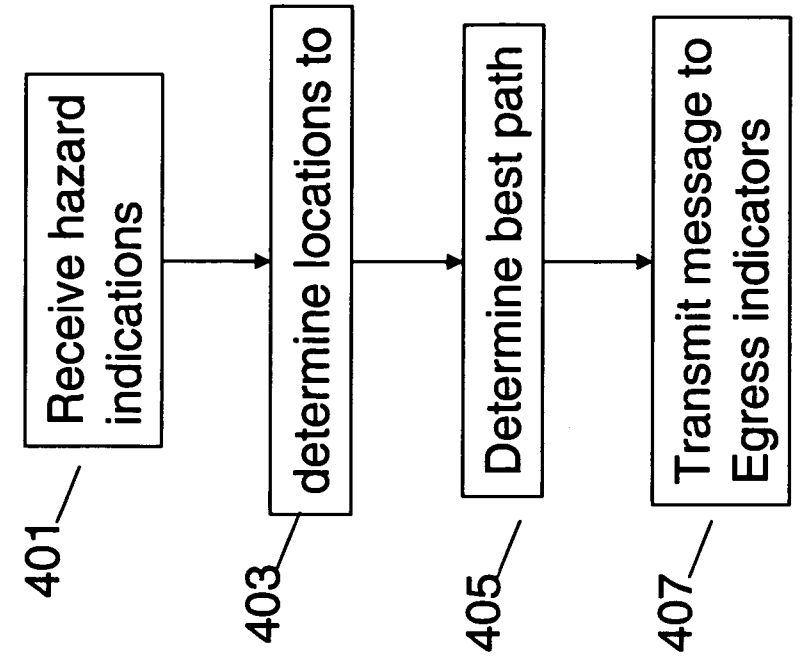

Receive hazard indications
401
determine locations to
403
Determine best path
405
Transmit message to Egress indicators
407

FIG. 4

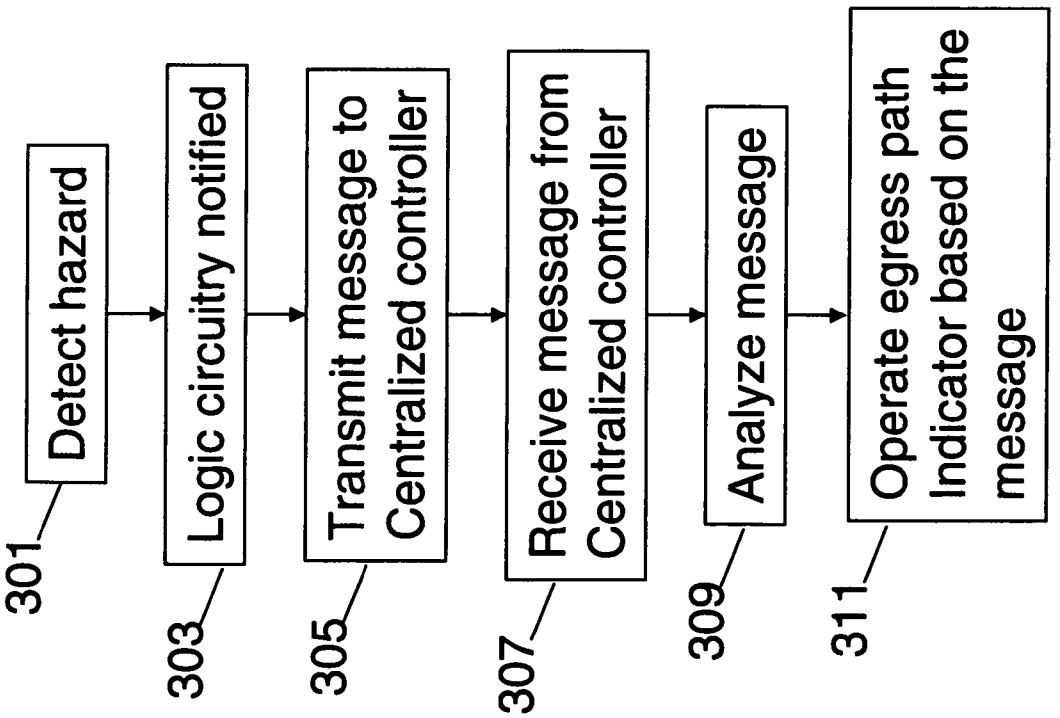

Detect hazard
301
Logic circuitry notified
303
Transmit message to Centralized controller
305
Receive message from Centralized controller
307
Analyze message
309
Operate egress path Indicator based on the message
311

FIG. 3

METHOD AND APPARATUS TO AIDE IN EMERGENCY EGRESS

FIELD OF THE INVENTION

The present invention relates generally to emergency egress systems and in particular, to a method and apparatus to aide in emergency egress.

BACKGROUND OF THE INVENTION

Emergency egress systems typically comprise egress path indicators dispersed around a structure to aide in emergency evacuation of the structure. Typically the egress path indicators comprise lights that are activated when a hazard is detected. A problem exists with prior-art emergency egress systems in that when a hazard is detected, all egress path indicators are typically activated. The activation of all egress path indicators may direct individuals towards the hazard. For example, if a hazard (e.g., a fire) is located near an exit, the activation of prior-art emergency egress systems may direct individuals towards the hazard/exit. As is evident, during an emergency, it may be beneficial to direct individuals towards another exit, away from the hazard, even though they have a longer distance to travel. Therefore, a need exists for a method and apparatus to aide in emergency egress of a structure that directs individuals away from a hazard.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing an emergency egress system.

FIG. **2** is a block diagram of an egress indicator.

FIG. **3** is a flow chart showing operation of the emergency egress system of FIG. **1**.

FIG. **4** is a flow chart showing operation of the egress indicator of FIG. **2**.

DETAILED DESCRIPTION OF THE DRAWINGS

In order to address the above-mentioned need, a method and apparatus are provided to aide in emergency egress of a structure. More particularly, egress indicators are co-located with hazard sensors. During detection of a hazard condition, locations of sensors detecting the hazard are identified and a pathway directing traffic away from the hazard is determined. Finally, the egress indicators are operated to direct traffic down the determined pathway.

Because egress indicators are co-located with hazard sensors, it is possible to identify those egress indicators that may direct traffic towards the hazard, thus making it possible to operate the egress indicators such that traffic is directed away from the hazard.

The present invention encompasses a method for operating an emergency egress system. The method comprises the steps of receiving a plurality of hazard indications, identifying locations of sensors detecting the hazard, and determining a path away from the hazard based on locations of the sensors detecting the hazard. A plurality of egress indicators are controlled to direct traffic towards the path, wherein the plurality of egress indicators are co-located with the sensors.

The present invention additionally comprises an apparatus comprising a receiver for wirelessly receiving an indication of a hazard condition, logic circuitry for identifying locations of sensors detecting the hazard, determining a path away from the hazard based on locations of the sensors detecting the hazard, and a transmitter for wirelessly controlling a plurality of egress indicators to direct traffic towards the path, wherein the plurality of egress indicators are co-located with the sensors.

The present invention additionally encompasses a method comprising the steps of detecting a hazard, wirelessly notifying a centralized controller of the hazard; receiving a message from the centralized controller in response to the notification, and operating an egress path indicator based on the received message.

Finally, the present invention encompasses an apparatus comprising hazard detection circuitry, a wireless transmitter for wirelessly notifying a centralized controller when hazard detection circuitry detects a hazard, and a wireless receiver for receiving messages from the centralized controller. An egress path indicator is provided along with logic circuitry for controlling the egress path indicator based on the messages received from the centralized controller.

Turning now to the drawings, wherein like numerals designate like components, FIG. **1** is a block diagram showing emergency egress system **100** deployed over a floor plan of an interior of an office building. Egress system **100** comprises a number of wireless devices **104-105** involved in hazard detection and determining a safest egress pathway. As is evident, the office building comprises perimeter wall **102** that encloses a plurality of offices **103** (only one labeled). Two exits **106** and **107** exist to provide egress from the structure.

Circular objects represent egress indicators **104** (only one labeled), each comprising a wireless transceiver, hazard detection sensor/circuitry, and an egress path indicator. The locations of egress indicators **104** are known by system **100**. Egress indicators **104** can include, for example, hazard detection circuitry and a transceiver attached to emergency lighting, hazard detection circuitry and a transceiver attached to audible indicators, exit signs, back up lighting, . . . , etc. Rectangular object **105** comprises a centralized control device **105** designed to determine a safe egress pathway. Control device **105** is provided with the locations of all egress indicators **104**. The indicators may auto configure with a mesh network. Control device **105** may be a gateway with automatic notification to emergency responders.

It should be noted that although FIG. **1** shows egress indicators **104** existing within a two-dimensional space, one of ordinary skill in the art will recognize that egress indicators **104** may be located in other environments, including 3-dimensional spaces and outdoor spaces. For example, egress indicators **104** may comprise lightning detection circuitry located on a golf course used to direct individuals away from a potential lightning strike. Irrespective of the environment where egress indicators **104** operate, egress indicators **104** are dispersed in known locations to assist in locating a hazard and providing a safest pathway away from the hazard.

When any egress indicator **104** detects a hazard, the information is wirelessly provided to centralized control device **105**, which analyzes which egress indicators detect the hazard, and determines a safest pathway away from the hazard. Centralized control device **105** then instructs various egress indicators **104** to operate in a manner to direct individuals along the safest pathway. Additionally, centralized control device **105** may be manually operated to activate predetermined egress paths. (ie. In the event of hazardous weather a predetermined path could be activated to direct people towards a tornado shelter)

As an example, if egress indicators **104** are equipped to detect fire activity, and a fire is detected near exit **106**, system **100** will operate to direct traffic away from exit **106** and towards exit **107**. The process of directing traffic is dependent upon the type of egress path indicator. The following set forth some examples of how egress system **100** may direct traffic away from a hazard.

- If the egress path indicators comprise lighting, the lighting will be used to direct traffic towards the desired exit. For example, only those egress lights will be operated that will direct traffic accordingly.
- If the egress path indicators comprise an audible warning system, the audible warning will direct traffic towards a desired exit.
- If the egress path indicators comprise standard commercial or industrial lighting used in corridors, such lighting may be equipped with supplementary red and green lights to be actuated accordingly.
- If the egress path indicators comprise a modifiable exit sign (e.g., one with a pixilated image) such an exit sign could change from the word "EXIT" to a directional arrow.
- If the egress path indicators comprise dual display egress lights capable of changing a directional arrow, such signs can be modified to a ⓧ or Ø symbol instead of a directional arrow.
- If the egress path indicators comprise sequenced lighting, the sequenced lighting along corridor or ceiling panel lights could be sequenced for directionality. In other words, the lighting may be activated such that the egress path indicators appear to flow towards an egress direction.

FIG. **2** is a block diagram of an egress indicator **104** and centralized control device **105**. Both indicator **104** and centralized control device **105** comprises antenna **202** coupled to transmitter/receiver (transceiver) **203**, in turn, coupled to logic circuitry **204**. Although various forms for antenna **202**, transceiver **203**, and logic circuitry **204** are envisioned, in a preferred embodiment of the present invention egress indicator **104** is formed with a wireless self assembling system with a mesh overlay. Such a system can be realized in an 802.15.4 chipset, for example a Freescale Inc. MC13192 transceiver **203** coupled to a Motorola HC08 8-bit processor **204**.

As is evident, egress indicator **104** additionally comprises hazard detection circuitry **205** coupled to logic circuitry **204**. In the preferred embodiment of the present invention hazard detection circuitry comprises standard fire detection circuitry; however, in alternate embodiments of the present invention other forms of hazard detection circuitry **205** may exit. Such other forms include, but are not limited to detectors that detect smoke, heat, flood water, chemicals, hazardous gases or byproducts such as radiation or carbon monoxide, . . . , etc.

Additionally, egress indicator **104** comprises egress path indicator **206** coupled to logic circuitry **204**. In the preferred embodiment of the present invention egress path indicator **206** comprises emergency exit lighting; however, in alternate embodiments other path indicators **206** may be employed.

When hazard detection circuitry **205** detects a hazard, logic circuitry **204** is notified. This event is wirelessly transmitted to centralized controller **105** along with an identification of the egress indicator **104**. Once received by the centralized controller's transceiver **203**, logic circuitry **204** is passed the message and immediately determines other egress indicators **104** sensing the hazard. The locations of the hazards are analyzed and a best egress pathway is identified by the centralized controller's logic circuitry **204**. The centralized controller's logic circuitry will then utilize transceiver **203** to wirelessly instruct various egress path indicators **206** to activate. More particularly, wireless signal **201** will be transmitted to all egress indicators **104** that will need to activate their egress path indicators **206**. Once the message is received by egress indicators **104**, logic circuitry **204** analyzes the message and determines whether or not to activate egress path indicator **206**. Egress indicators **104** will engage their egress path indicators only if instructed to do so.

FIG. **3** is a flow chart showing operation an egress indicator of FIG. **2**. The logic flow begins at step **301** where hazard detection circuitry **205** detects a hazard condition. As discussed above, the hazard condition may comprise an indication of smoke, heat, flood/water, chemicals, gases, or radiation detected via a smoke detector, a heat detector, a flood/water detector, a chemical detector, a hazardous gases or byproducts detector, or a radiation detector.

Continuing, once a hazard is detected, this fact is passed to logic circuitry **204** (step **303**) and logic circuitry **204** instructs transmitter/receiver **203** to wirelessly transmit a message of the hazard detection along with the identification of egress indicator **104** to centralized processor **105** (step **305**). In response, transmitter/receiver **203** receives a wireless message from centralized controller **105** (step **307**). The message is analyzed by logic circuitry **204** (step **309**) and the egress path indicator **206** is operated based on the message (step **311**).

It should be noted that for audible systems, the message received from centralized controller **106** may be an audible message to announce via egress path indicator **206**. In this situation egress indicator **206** will automatically be activated announcing the received massage.

In yet a further embodiment of the present invention, egress path indicator **206** may comprise directional lighting that may operate to direct individuals along one of several paths. In this situation the message received from centralized controller **106** will indicate how to operate egress path indicator **206** to direct individuals along a safest path.

FIG. **4** is a flow chart showing operation of centralized controller **106** of FIG. **2**. The logic flow begins at step **401** where at least one hazard indications is wirelessly received from a hazard detector via over-the-air signals **201**. The hazard indications may comprise indications from detectors such as a smoke detector, a heat detector, a flood/water detector, a chemical detector, a hazardous gases or byproducts detector, or a radiation detector. Additionally, hazard indication messages comprise the identification of the circuitry detecting the hazard.

At step **403**, logic circuitry receives the messages and determines the locations of the circuitry detecting the hazard. Based on this information a best egress path is determined at step **405**. Finally, at step **407** appropriate instructions are wirelessly transmitted to control egress indicators **104**. The appropriate instructions may, for example, control lighting, control an audible warning system, control a modifiable exit sign, control a directional arrow, control sequenced lighting, . . . etc.

For example, if egress path indicators **206** comprise emergency lighting, instructions on which indicator **104** to operate may be given. Alternatively, if egress path indicators **206** comprise an audible warning system, an appropriate message (e.g., "proceed to Northwest exit") may be transmitted to all egress indicators **104**. In yet a further embodiment of the present invention, if egress path indicator **206**

may comprise directional lighting an appropriate message may be transmitted to all egress indicators **104**, properly instructing them in the operation of their lighting.

While the invention has been particularly shown and described with reference to a particular embodiment, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention. For example, while the above embodiment shows egress path indicators and hazard detection circuitry existing within the same device, one of ordinary skill in the art will recognize that these devices may simply be located in close proximity to each other. It is intended that such changes come within the scope of the following claims.

The invention claimed is:

1. A method for operating an emergency egress system, the method comprising the steps of:

receiving a plurality of hazard indications;

identifying locations of sensors detecting the hazard;

determining a path away from the hazard based on locations of the sensors detecting the hazard; and

sequencing a plurality of ceiling panel lights to direct traffic towards the path, wherein the plurality of ceiling panel lights are co-located with the sensors.

2. The method of claim **1** wherein the step of receiving the plurality of hazard indications comprises the step of receiving a wireless transmission from at least one hazard detector.

3. The method of claim **1** wherein the step of receiving the plurality of hazard indications comprises the step of receiving a wireless transmission from at least one hazard detector, and wherein the hazard detector is taken from the group consisting of a smoke detector, a heat detector, a flood/water detector, a chemical detector, a hazardous gases or byproducts detector, and a radiation detector.

4. The method of claim **1** wherein the step of controlling a plurality of ceiling panel lights comprises the step of wirelessly controlling the plurality of ceiling panel lights.

5. An apparatus comprising:

a receiver for wirelessly receiving an indication of a hazard condition;

logic circuitry for identifying locations of sensors detecting the hazard, determining a path away from the hazard based on locations of the sensors detecting the hazard; and

a transmitter for wirelessly sequencing a plurality of ceiling panel lights to direct traffic towards the path, wherein the plurality of ceiling panel lights are co-located with the sensors.

6. The apparatus of claim **5** wherein the indication of the hazard comprises an indication of smoke, heat, flood/water, chemicals, gases, or radiation.

7. A method comprising the steps of:

detecting a hazard;

wirelessly notifying a centralized controller of the hazard;

receiving a message from the centralized controller in response to the notification; and

sequencing ceiling panel lights based on the received message.

8. An apparatus comprising:

hazard detection circuitry;

a wireless transmitter for wirelessly notifying a centralized controller when hazard detection circuitry detects a hazard;

a wireless receiver for receiving messages from the centralized controller;

an egress path indicator; and

logic circuitry for sequencing ceiling panel lights based on the messages received from the centralized controller.

9. The method of claim **1** wherein the step of sequencing the plurality of ceiling panel lights comprises the step of wirelessly transmitting instructions to the plurality of lights causing them to sequence.

10. The apparatus of claim **7** wherein the step of sequencing the ceiling panel lights comprises the step of wirelessly transmitting instructions to the plurality of lights causing them to sequence.

11. The apparatus of claim **8** wherein the logic circuitry sequences the ceiling panel lights by wirelessly transmitting instructions to the of lights causing them to sequence.

* * * * *